The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Problems in Agriculture

SINCE the dawn of civilisation Adam has delved and Eve has spun and mankind has lived by the fruits of the soil. A fund of experience has been gained over these thousands of years and as a result, subject to the vagaries of the weather, mankind has fairly successfully maintained himself by the products of agriculture. Experience has proved to be of local value rather than of general value, and in the last hundred years, during which the whole surface of the world has been opened up to mankind for the first time, we have discovered that local conditions of weather, of soil, and of flora and fauna profoundly affect the practice of agriculture and the success that can be achieved from it. During the same period, moreover, the population of the earth has increased very considerably, an increase due very largely to the impact of science on human life and institutions. The fertility of the human race has probably not varied by any considerable amount, but the expectation of life has greatly increased. For this reason we have in another form to-day the problem that faced Sir William Crookes and his colleagues of providing sufficient food for the increased population. The greatest single contribution to post-war reconstruction which has yet been suggested is the provision of an adequate standard of nutrition for all peoples of the earth. In *Gulliver's Travels*, written in the early years of the 18th century, Swift already foresaw this for he says: "And he gave it for his opinion, that whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together."

Professor Engledow in his Jubilee Memorial Lectures, which have just been published by the Society of Chemical Industry, has given a short, comprehensive, and fascinating account of the application of science to the land. These problems are chemical, physical, biological, meteorological—indeed they call upon most terrestrial sciences. The problems are complex and appear to be exceedingly difficult of solution, even though expressible in simple terms. The recital of them recalls the opinion of Voltaire: "I believe that a sensible peasant knows more about agriculture than authors who from the seclusion of their libraries issue

On Other Pages

instructions as to how the earth is to be ploughed." "Authors in their libraries" are now going out into the field to do practical experiments in order to discover the reasons for some of the age-old practices of agriculture and to find means whereby the speculative nature of agriculture may be converted into a gilt-edged investment through scientific control of the conditions and practice of the soil and of the plants and animals that grow thereon.

The five great elements, about which the problems of the land range, are soil, weather, crops, stock, and disease. The basic questions of permanent agriculture and utilisation of land are the conservation of the soil, water, and soil fertility. Soil conservation has been discussed in these pages on more than one occasion during the past few years, and special reference made to the difficulties experienced in the U.S.A. and in Africa. The unwise haste with which farmers have cleared virgin land for cultivation in some parts of the world has led to disastrous soil erosion. We now recognise that husbandry must be made erosion-proof; this can be done partly by trial and error, but better by investigation of the relation between physico-chemical soil constitution and the liability to erosion. This offers to science a vast, pressing, problem.

Irrigation and drainage in themselves set up problems of no small magnitude. After civil engineering has designed great irrigation works and results may still be unsatisfactory because they will depend upon the practicability of removing excess water by a drainage system and of the kind and amounts of inorganic soil. Through continual evaporation at the surface the upper soil layers may be charged with concentrations of deleterious salts harmful to plant life. For agricultural science, the fundamental drainage problem is water movement in soils.

The chemistry of the soil has lately been discussed by Mr. L. T. Lowe in a lecture at Cardiff (*Chem. and Ind.*, 61, p. 230) in which it is pointed out that throughout the world there are four or five distinct types of soil dependent on whether the regions are cold and wet, arid, temperate with moderate rainfall, or humid. Soil chemistry presents an abundance of physico-chemical problems, many of which cannot be regarded as even on the way to solution. Soil fertility is too complex for close scientific analysis and is controlled by several factors: water supply, aëration, mechanical conditions, physical properties, organic matter, and microflora. Reference has been made in these columns previously to the effect of small traces of elements in the soil and it is only necessary to add here that the special difficulty of trace chemistry in soils arises through heterogeneity and can be met only by great improvement in sampling technique and appropriate statistical analysis. It is, moreover, quite a serious matter that the soils of the world are continually being denuded of potassium and the potassium deposits of the world are at an even greater rate being used up.

Space does not permit us to follow Professor Engledow through the many problems connected with water, air temperature, wind, rainfall, nor into the realms of biology. The effects and control of plant disease and of insect pests present immense problems of their own which have been before the chemical industry for some time. There are two observations, however, to which particular attention may be directed here. Crop drying is beginning to be practised and the fuel interests in the country are taking this aspect of agriculture very much under their wing. Professor Engledow points out that "portable dryers on the field would avert the transport of over 13 tons of water for each ton of dry matter taken to the sugar-beet factory. If milk could be so dried as to give, on remixing with water, a product nutritionally and in taste indistinguishable from fresh milk, the effect on dairy farming might be far-reaching and it might include the possibility of inter-territorial trade in milk."

Our second point is that in the light of the articles which have appeared in THE CHEMICAL AGE on the problem of humus Professor Engledow has pointed to the extreme divergence of opinion which exists upon this important subject: "First, that humus increases the water holding power of light soils and makes heavy ones more workable and drainable, but has no other primarily important function; and at the other extreme, that humus is indispensable to the maintenance of soil fertility, to the health of crops, and even of the men and beasts that consume the crops.

NOTES AND COMMENTS

Official Agricultural Science

CONSIDERING the importance of agricultural problems, as indicated in our leading article this week, it is reassuring to read that the question is not being neglected by Parliament. The query was raised last week in the Commons as to whether the Agricultural Research Council existed on a whole-time basis and whether adequate funds were available for it to carry on its work. The Lord President pointed out that although the Council did not serve on a full-time basis, it did possess a small permanent scientific staff, and that it met at regular intervals.. Grants in aid of the Council had increased from £58,571 in 1940/41 to £125,000 in 1942/43. Furthermore it worked in close collaboration with the D.S.I.R. in relation to chemical problems of mutual interest, and with the responsible departments in regard to fertilisers; and, in connection with specific investigations, it made contacts with the research organisations of firms concerned with chemicals and fertilisers, when necessary. Mr. Hudson reinforced Sir John Anderson's remarks by reminding Members that the results of agricultural research were disseminated in this country mainly through the research, advisory, and educational organisation set up by the Ministry of Agriculture, and that, although the facilities for maintaning contact with foreign agricultural bodies had been drastically curtailed, an extensive abstracting system was being kept up, and was utilised to the full.

Germany's Promise to Pay

GERMANY'S creditors in Europe who, either under threats or other variants of the Nazi method of extraction, have been supplying the German war machine with material, may derive some comfort from a promise which has just been given by Dr. Langfried, Secretary of State to the German Ministry of Economics. He is reported to have written, in a newspaper article, that the credits of some European countries in Berlin have greatly increased as a result of the war, but that after the war all these will be repaid in kind. They will thus, he says, form the base of a development of the European economy. We may assume that the article was written in order to pacify some anxious merchants who are not entirely satisfied with their rôle of creditor to Berlin. Perhaps they will feel easier in mind now that they have been promised "something" even if, with memories of Hitler's pre-war methods of payment in kind, the selection of the goods with which the debt is to be liquidated will be made from the point of view of what is most easily produced and of least value to Germany rather than from any regard to her neighbours' requirements. In any case the question will not arise. The Allies are unlikely to pay Germany's war debts for her.

Price Control within Germany

THE German Government campaign for the reduction of cartel-controlled prices has aroused some concern in the chemical industry. Asked for proposals for the reduction of prices, the chemical cartels have not responded too enthusiastically, so that the Reich Commissioner announced his intention to fix prices in accordance with costs as established by him through examination of the books of one plant which normally will be the best-managed one. This has aroused loud protests from the German chemical industries, who argue that (a) many chemicals are made by a number of different processes, so that conditions in one plant do not permit conclusions on others; and (b) the use of more expensive raw materials, which are reflected in higher selling prices, for the manufactured article is often preferable for reasons of national self-sufficiency. Careful examination of all factors would take a long time, and negotiations with the Reich Commissioner have already been started.

Russia's Industrial Progress

THE Russians are not noted for their anxiety to impart information about the great industrial progress which undoubtedly lies behind their magnificent work in the field. They no doubt take the view that it is better to keep friends guessing than to allow the enemy the smallest clue to what they may meet in the future. But secrecy, once accepted as a policy, becomes a habit, with the result that little news of recent developments in fields not directly connected with the fighting forces has been forth-

coming. Now, however, we learn that films designed to give a clearer view of what the Russians are doing, which have already been shown to the few at the Imperial Institute, will shortly be available for English cinemas. English commentaries have been written by Professor J. B. S. Haldane. One of the films shows an air-liquefying machine, designed by Professor Peter Kapitza, which is no larger than an ordinary household geyser.

Paper Saving

THE new Ministry of Supply Control of Paper Order will cause some heart-searching. It provides, most sensibly, that only the quantity of paper that is reasonably required may be used for any document, leaflet, pamphlet, report, letter, or memorandum, whether printed, written, or typewritten. The trouble begins when a person or concern seeks to interpret the qualifying word "reasonable." Each man's cause is of utmost importance to himself and what he will consider an unjustifiable curtailment of his freedom of speech may be regarded by his neighbour as a welcome economy in the consumption of valuable paper. Undoubtedly there are still glaring examples of waste of this material which is more closely bound up with the production of munitions than most people realise. Recently we were shown an amendment to a Government publication. It occupied a full page of paper a little smaller than that usual in novels. It was well covered with print of an official and meaningless sort, but the net result of it all was to correct a single word in the publication in question.

Dehydration Makes Good

EVIDENTLY dehydration has passed the test. Certainly the examples of vegetables we have met which have been treated in this way appeared to have lost nothing after being returned to their pre-dehydrated form. We are not surprised to hear that the Food Ministry has decided on a considerable extension of the plant in this country beyond the fifteen centres already being set up. Mr. Mabane stated in a written parliamentary reply that the total annual capacity of the plants is estimated at about 7500 tons of mixed dried vegetables, for which approximately 140,000 tons of fresh vegetables will be required. Distribution in the coming spring will be limited to the forces and certain emergency services. It is as well that no wider distribution is contemplated at the moment, for this would add to the problem of fuel saving. Much longer periods of heating in water are required to make dehydrated vegetables edible than for the natural kind. But if these goods are going to the forces and emergency services only, the advantages clearly outweigh the handicap which would emerge if they were presented to the housewife.

Wholesale Prices in August

WHILE wholesale prices generally showed a small decline in August, as compared with July, an interesting feature was the complete steadiness of the iron and steel, the non-ferrous metals, and the chemicals and oils groups. Coal, too, was unchanged, following the July rise due to the price increase. The Board of Trade index figure for all the goods covered is 0.7 per cent. lower than in July. It is only the second decline to be recorded since the outbreak of war. Iron and steel remain at 182.7 (1930 = 100), non-ferrous metals at 126.0, coal at 179.9, and chemicals and oils at 134.4.

New Control Orders

Export of Plastics and Chemicals

Under the Export of Goods (Control) (No. 38) Order, 1942 (S. R. & O. 1942, No. 1812, price 1d.), which comes into force on September 28, licences will be required to export, to all destinations: thermite; wire spirals, whether coiled or not, wholly or mainly of molybdenum or tungsten; diacetin; dichlorodifluoromethane; selenium and its compounds; and triacetin. Licences will also, in future, be required to export adhesives and cements, wholly or mainly of synthetic resin; and synthetic resins, and plastic materials derived from synthetic resins or from cellulose, or from casein, in the form of granules, powders, blocks, rods, tubes, sheets or strip, whether or not shaped or reinforced with other materials.

Liquid Paraffin

The Minister of Fuel and Power has made the Petroleum (No. 2) Order, 1942 (S. R. & O. 1942, No. 1725) which came into force on September 1. The order provides that, except for medicinal purposes or under the authority of a licence, liquid paraffin shall not be treated or used or blended with any other petroleum product or any other substance.

Selenium and Tellurium

An Examination of their Uses in Chemistry and Metallurgy

SELENIUM is widely distributed over the world's surface, but the total amount has been calculated to be equal only to that of gold or bromine. The availability of tellurium is less than half that of selenium, and both of these elements are usually classed among the rarer elements. However, they are not rare in the sense of being unavailable to commerce, since nearly 1,000,000 pounds of selenium are recovered yearly in peace time. World production of tellurium is about 200,000 pounds yearly. Selenium and tellurium are readily available, being concentrated in small amounts in most of the important sulphide ores of copper, silver, gold, and nickel-copper which are mined in the United States, Canada, Mexico, South America, Sweden, Central Europe, Northern Rhodesia, Russia and Japan. At some point during the process of refining copper, nickel, silver, and gold it is necessary to remove selenium and tellurium. In a comprehensive article on the industrial uses of these elements,* after giving details of their well-known employment in photo-electric cells and for other purposes depending on their physical properties, and in the ceramic industries, the writers continue with a survey of their chemical and metallurgical uses.

Effect on Cast Iron

Selenium and tellurium, they write, combine with practically all metals to form selenides and tellurides which are usually slightly more soluble than the corresponding metal sulphide in the matrix of the parent metal. Many industrial applications of iron castings such as camshafts, gears, cast-iron paving blocks, and railway wheels require the surface of the casting to be highly resistant to abrasion. This hard surface is generally developed either by chilling alone or in combination with variations in the composition of the cast iron. An outstanding development is the recent discovery that an appreciable increase in the depth of chill in iron can be obtained by the inclusion of minute amounts of tellurium. Tellurium acts as a powerful carbide stabiliser; that is, a trace of tellurium keeps carbon in the form of iron carbide during the pouring and solidification of cast iron. Selenium might be expected to act like tellurium, but actually the general tendency of selenium seems to be to reduce the depth of chill. As the following table shows, the addition of even 0.5 per cent. selenium to a cast iron containing 3.3 per cent. carbon and 1.75 silicon (as well as 0.6 manganese, 0.1 sulphur, and 0.1 phosphorus) still results in a reduction of chill:

% Se	% Te	depth of chill, in.
...	...	0.38
0.01	...	0.37
0.10	...	0.35
0.30	...	0.31
0.50	...	0.23
...	0.01	0.48

A slight excess of tellurium tends to form a carbide network surrounding the former austenitic boundaries through all portions of the casting and thereby detracts from the desirable physical properties. While the amount of tellurium used in making a ton of chilled iron is small, the total tonnage of cast iron produced annually makes the potential requirement for tellurium in the grey iron industry a matter of several hundred tons a year. In the production of malleable iron, it is claimed that traces of tellurium have little influence upon the subsequent annealing process after the iron solidifies. This makes it possible to use a relatively large amount of silicon to promote annealing and at the same time to be assured of obtaining white iron when the metal is poured. The annealing time for ordinary sections is thus greatly reduced, and it is practicable to cast much larger sections than was possible previously without tellurium. Selenium as well as tellurium can be added to cast steel to produce a fine-grained structure, free from casting defects and possessing good ductility.

Small amounts of selenium and tellurium are added to stainless steels to improve machinability without impairing corrosion properties. Sulphur as ferrous sulphide has a lower solubility in the iron matrix, and the rolled steel shows stringers or streaks as a result of separation of slag-like sulphides which are deleterious to the properties of the steel. Selenium is generally preferred to tellurium, and the amount usually added is 0.2-0.3 per cent. Selenium is added in the form of iron selenide in order to reduce the loss of selenium by volatilisation. The use of selenium in stainless steel as a free-machining and anti-galling agent is commercially established.

Tellurium-Lead

The remarkable corrosion resistance and work-hardening properties of lead alloys containing small percentages of tellurium were first described by Singleton and Jones. The addition of 0.1-0.5 per cent. tellurium to lead produces an alloy having a finer grain structure and a smoother outer surface than ordinary lead. Tellurium-lead resists corrosion by most strong acids to a

* By G. R. Waitkins, A. E. Bearse and R. Shutt in *Ind. Eng. Chem.*, 1942, **34**, 8, 899.

remarkable degree and when attacked leaves a uniform surface unlike the pitted surface obtained when pure lead is used. The rate of solution of a lead anode containing 0.05 per cent. tellurium is one-tenth that of commercial lead in an electrolyte containing 15-20 per cent. by weight of sulphuric acid. The presence of 0.5 per cent. tellurium is reported to double the life of lead in sulphuric acid plants. Because of its great acid resistance, tellurium-lead is finding increasing use for tank linings, anodes, heating coils, and other purposes in plating and pickling equipment.

Tellurium-lead alloy as first cast has about the same malleability and other desirable physical properties as pure lead. However, this alloy has the useful property of work-hardening; that is, tellurium-lead actually increases in strength and toughness as it is rolled or stretched. This property of work-hardening is best illustrated by the fact that a lead-tellurium pipe, stretched and elongated so that its wall thickness is reduced by one-third, is actually more resistant to bursting than the original pipe. Tellurium-lead withstands low temperatures and vibration much better than pure lead, and consequently, thinner-walled pipes are practicable for carrying water or steam which is subject to pressure fluctuations. Tellurium-lead alloys are also finding some use in the manufacture of cable sheathing.

Alloys with Copper and Tin

Small additions of sulphur, selenium, or tellurium greatly improve the machinability of copper and copper-rich alloys without producing the low ductility at high temperatures associated with lead additions. The tensile strength of copper is increased slightly, the ductility decreased without becoming brittle, and the conductivity is decreased slightly. There is a difference of opinion on the relative merits of selenium and tellurium in their ability to increase machinability, although both are used commercially in preference to sulphur. Tellurium increases the machinability of commercial bronze (90 copper-10 tin), 1.5 per cent. tin bronze, and 3 per cent. silicon bronze. Hardness and strength are practically unaffected up to 0.6 per cent. tellurium, while toughness and ductility are decreased slightly. Selenium can be added readily to silicon-copper and copper-nickel alloys. It is reported that alloys containing 0.5 per cent. selenium can be hot-rolled or cold-worked and show practically no change in tensile properties, while their machinability is three to four times that of the alloys without selenium. Selenium-copper or tellurium-copper alloys, containing approximately 0.05 to 3 per cent. selenium or tellurium, having low contact resistance, and possessing anti-welding properties, are used in making arcing tips for electrical contacts. Selenium and tellurium have also been added to beryllium-base alloys.

Additions of tellurium in concentrations of 0.1-1.0 per cent. increase the hardness and tensile strength of tin. Tellurium also is added in 0.12 per cent. concentration to tin-rich alloys to refine the grain, to aid casting, and to improve physical properties at high temperature. An alloy containing approximately four per cent. silver and the remainder tellurium has been patented for making resistors having a negative temperature coefficient of resistance.

Protection of Magnesium

Selenium and tellurium in 0.5-3 per cent. concentrations have been added to magnesium-manganese alloys to increase corrosion resistance. It has been reported that tellurium is effective in small amounts; selenium, although effective, is difficult to alloy. Magnesium and magnesium-rich alloys are subject to severe attack by sea water, and require chemical treatment to reduce corrosion and improve paint adherence. These treatments form corrosion-resistant oxide, chromate, fluoride, or selenium coatings on the metal surface. Corrosion-resistant coatings of red selenium are obtained on magnesium by immersing the metal for a short time in a solution containing ten per cent. selenious acid and one per cent. sodium chloride or in solutions containing sodium selenite and phosphoric acid. These selenium coatings adhere firmly to magnesium and reduce attack by sea water or salt spray. The films are self-healing to some extent and are able to repair damage resulting from small scratches. Paint adherence is improved. Selenium treatments have found considerable commercial application in Europe but only slight use in America. Selenium and tellurium compounds act as brighteners in some plating baths, although they are not used industrially. Small concentrations in nickel-plating baths promote the formation of very bright but somewhat brittle deposits. Aromatic sulphonates and phenylarsonic acid reduce the brittleness of the plate.

Chemical Uses

In a general way sulphur, selenium, and tellurium are related chemically, and form series of compounds which have analogous formulas and somewhat similar properties. The outstanding chemical difference between sulphur and selenium or tellurium lies in the fact that all the inorganic selenium acids, such as hydrogen selenide and selenious and selenic acids, are relatively unstable and revert to free selenium in the presence of even mild oxidising or reducing agents. Oxygenated organic selenium and tellurium compounds, such as selenones, are also considerably less stable than their sul-

phur analogues, but heterocyclic compounds containing sulphur, selenium, or tellurium have similar properties. The specific nature of the oxidising action of selenium dioxide on organic compounds was first pointed out by Riley in 1935. Many papers have been published since that time showing the wide application of this reaction to the preparation of new compounds unobtainable by other methods—for example, from terpenes, sterols, bile acids, heterocylic nitrogen compounds, unsaturated hydrocarbons, aldehydes, and ketones.

Oxidation and Dehydrogenation

In general, selenium dioxide oxidations take place as follows: in compounds containing methylene or methyl groups, activated by an adjacent double bond, carbonyl or aldehyde group, or adjacent benzene nucleus, the activated group is oxidised to the corresponding ketone or aldehyde group. Adjacent nitrogen atoms in heterocyclic compounds also activate the oxidation of the methylene or methyl group. In glacial acetic acid or acetic anhydride these oxidations generally proceed only as far as the alcohol stage, and the products may be isolated as the acetates. Tellurium dioxide has been shown to be less satisfactory than selenium dioxide as an oxidising agent for organic compounds. Oxygen compounds of selenium are less stable than corresponding sulphur or tellurium compounds. This may explain why selenium dioxide has outstanding oxidising properties in comparison with sulphur dioxide or tellurium dioxide; that is, selenium dioxide is able to give up its oxygen to other compounds more readily than either of the other two oxides.

HEATS OF FORMATION

Compound	State	Kg.-cal.
Sulphur dioxide	SO_2 (liquid)	75.27
Selenium dioxide	SeO_2 (solid)	57.08
Tellurium dioxide	TeO_2 (solid)	78.30
Sulphuric acid	H_2SO_4 (liquid)	189.75
Selenic acid	H_2SeO_4 (liquid)	126.6
Telluric acid	H_2TeO_4 (aq.)	169.5

It has been known for many years that sulphur is capable of reacting with certain alicyclic compounds at elevated temperatures to produce their aromatic counterparts by the removal of hydrogen and other atoms or groups from the alicyclic molecule. In this way naphthalene has been obtained from tetralin and retene from abietic acid. Dehydrogenations of this type have also been brought about with the aid of metal catalysts, such as platinum and palladium. However, it was not until 1927 that Diels discovered that selenium could bring about the dehydrogenation of hydroaromatic compounds. Since then, selenium dehydrogenations have been instrumental in clarifying the structure of complex organic compounds, particularly natural products such as the sterols, bile acids, saponins, vitamins, hormones, and terpenes. In dehydrogenations sulphur shows a greater tendency than selenium to enter into reaction with the organic material to form undesirable products. Organic sulphur compounds thus formed tend to obscure the desired reaction and to diminish the yield. In dehydrogenations with either sulphur or selenium, the hydrogen is removed as hydrogen sulphide or hydrogen selenide, while with palladium or platinum catalysts the action is strictly catalytic, and free hydrogen is produced.

Selenium dehydrogenations are ordinarily carried out at 280-350° C., and in extreme cases temperatures as high as 450° C. have been used. At such high temperatures it is obvious that rearrangements and the elimination of groups may occur in the molecule simultaneously with dehydrogenation. The compound is heated with selenium for twenty-four hours or longer, depending upon the ease of reaction. The quantity of selenium used will vary with the type of compound under investigation, and in some instances ten times as much selenium as organic compound has been found desirable although much less is ordinarily required.

Selenium as Catalyst

Copper and mercury have been employed as catalysts in the past to reduce the time required for decomposing organic compounds with concentrated sulphuric acid in the Kjeldahl method for the determination of nitrogen. Selenium, either alone or in conjunction with mercury, has been found to act as a powerful Kjeldahl catalyst and reduces the time required for digestion of nitrogenous matter to one-third or less. Unlike mercury, selenium does not form a complex compound with ammonia; however, the use of excess selenium leads to some loss of ammonia nitrogen. Bradstreet concludes that the quantity of selenium used as a catalyst should not exceed 0.25 gram alone or in combination with copper or mercury. The use of selenium plus mercury catalyst is also recommended in semimicroanalysis. A combination of selenium and vanadium oxide is recommended for Kjeldahl coal analyses, while a mixture containing sodium sulphate and sodium selenate is suggested in the analyses of rubber. The darkening of sulphite pulping solutions and the charring of wood pulp have been ascribed to the catalytic action of selenium derived from the pyrites used in making sulphite liquor. However, small amounts of selenium in the pyrites used for paper manufacture are not objectionable. The charring action of selenium in this case is probably explained in the same way as its catalytic action in Kjeldahl's digestion.

One of the important problems that faced

the industrial chemist about thirty years ago was to devise some economical means for converting cheap liquid oils, such as palm, cottonseed, and fish oils, and waste oleic acid or oleins, into solid products which could serve as raw materials in the soap, candle, and edible fat industries. This problem was solved with the discovery that oleic acid and oleins could be transformed into solid stearic acid and stearins by hydrogenation in the presence of nickel catalysts. During the period before the discovery of catalytic hydrogenation, the process of fat hardening by catalytic isomerisation (elaidinisation) was proposed. Nitrogen oxides, sulphur dioxide, and sodium bisulphate were considered as catalysts, but because of the low yields and the formation of undesirable by-products, nothing came of this proposal.

Bertram was the first to make a thorough study of selenium as an elaidinisation catalyst, and to show that both selenium and tellurium could be applied to the preparation of hardened fats from olein, palm oil, or peanut oil. It was observed that the elaidinisation reaction of various unsaturated fats and oils takes place rapidly at 150-220° C. in the presence of 0.03-0.1 per cent. selenium. With pure oleic or elaidic acid, the equilibrium of the reversible elaidin reaction was found to lie at 67 per cent. elaidic acid. No oxidation, polymerisation, or hydrogenation was observed. The following table shows some of Bertram's results.

ELAIDINISATION OF OLEIN WITH SELENIUM

Catalyst	% Used	Hours of heating	Temperature, ° C.	% Elaidic acid formed
		Pure olein		
Se	0.1	8	200	55
Se	0.3	8	180	67
H_2Se	0.5	1	230	66
		Technical olein		
S	0.1	4.5	220	13.5 (dark colour)
Crude Se	0.1	3	220	23.0 (light)
Crude Se	0.2	1	180	35.0 (light)
$SeBr_2$	0.5	3	210	32.0 (light)
SeO_2	1.0	2	240	30.0 (light)
SeSn (alloy)	0.3	2	230	35.0 (light)

Several references in the literature on the subject suggest that selenium has exceptional antioxidant properties in products such as printing inks, mineral oil, refined transformer oil, and linseed oil. Selenium also has a powerful gelation-retarding action on tung oil. It has been found that minute quantities of selenium impart remarkable non-drying properties to drying oils, such as linseed, oiticica, and tung. When these oils were heated for a few minutes at about 250° C. with 0.1-0.5 per cent. selenium, the resultant products were found to resist drying or baking in comparison with the untreated oils.

Selenium and tellurium are used in the compounding of rubber in concentrations of 0.1-2.0 per cent. to improve resistance to heat, oxidation, and abrasion, and to increase resiliency, while the use of selenium as an insecticide has received considerable attention in the past few years. A large number of selenium- and some tellurium-containing dyes and intermediates have been synthesised and evaluated. The properties of these dyes have not been sufficiently outstanding to justify their high cost of production.

Active selenium sulphide (prepared by the reaction of hydrogen sulphide and selenium dioxide) is extremely sensitive to mercury vapour. Sheets of paper are impregnated with this material for test purposes, and the darkening of the paper in a given time is proportional to the concentration of mercury in the air. Selenium sulphide detectors have been suggested for use in laboratories where there is a potential hazard as a result of the use of mercury (on laboratory floors, etc.). The lower range of sensitivity of this detector is approximately 150 micrograms of mercury vapour per cubic meter of air.

In recent years the study of the toxicity of selenium has received considerable attention. Since some selenium compounds, such as hydrogen selenide and selenium oxychloride, are highly toxic and dangerous to handle, the erroneous belief has been widely accepted that all compounds containing selenium are dangerous. This belief is not justified, since most selenium compounds may be used without danger if suitable precautions are observed. These should include adequate ventilation to prevent inhalation of volatile selenium compounds or selenium-containing dusts, and protection of the skin against contact with corrosive selenium compounds such as selenium dioxide, selenium monochloride, and selenium oxychloride. Although little attention has been given to the toxicity of tellurium compounds, they are believed to resemble selenium compounds in this respect.

French Chemical Industry

Raw Material Shortage : Workers Wanted in Germany

THE full reports of three leading French chemical combines—Rhône-Poulenc, St. Gobain, and Kuhlmann—for the past year have now become available and show the adverse effect of difficulties in the raw material supply.

The Société des Usines Chimiques Rhône-Poulenc points out that the shrinkage of export business could only in part be offset by larger sales in the home market. The production programme was adjusted to meet the vital necessities of the country. The fulfilment of the company's task as a supplier of many key products was severely hindered by lack of certain starting materials, coal and energy. The company has an interest in the Société Nationale des Pétroles d'Aquitaine, it provided larger financial means also for Rhodiaceta (the rayon producer) and acquired control of Société Générale d'Applications Thérapeutiques "Théraplix." The net profit remained at 74.1 (73.9) mill. francs. No capital increase is intended for the time being as large liquid funds are still held by the company.

Effect of Price Regulation

Manufactures des Glaces et Produits Chimiques de Saint Gobain, Chauny, et Cirey report that sales declined in quantity and value, chiefly because of the lack of certain raw materials and faulty distribution of coal and electricity. Higher prices for raw materials combined with the limitation, by regulations, of the selling price for finished products affected profits adversely. New productions only partly offset the decline in sales of old products. The difficulties in the supply of phosphates and pyrites continued, and the output of superphosphates was further curtailed. In some works production continued on the basis of domestic phosphates, but the shortage of sulphuric acid was also noticeable. The output of nitrogenous fertilisers declined chiefly because of coal supply difficulties. Less than half the capacity of plant producing chlorine and soda products was in use, and the electro-chemical works suffered from lack of power. The decline in the output of cyanides was less steep, the production of aluminium sulphate remained unchanged, while increases were noted for hydrochloric acid, and for potassium and sodium sulphate and silicate. The production of lead arsenate was successful, but the manufacture of copper sulphate declined. A new plant was opened for phthalic anhydride, and research work was influenced largely by attempts to begin new production. Several works for plastics and cellulose derivatives were built, involving considerable financial expense. A new plant for synthetic ammonia, nitric acid, and nitrogenous fertilisers was erected jointly with several other firms. The net profit is shown at 89.2 (78.5) mill. francs.

Manufactures de Produits Chimiques du Nord Etablissements Kuhlmann also draw attention to the difficulties arising from the shortage of raw materials, though some compensation was derived from the large variety of products made by the company. Conditions in plants using pyrites and sulphuric acid were particularly difficult. The production of phosphatic fertilisers was 20 per cent. of the 1939 figure. The output of organic products declined by 26.2 per cent. as compared with 1939. The manufacture of dyestuffs and intermediates was greatly affected by this decline.

Transfer of Chemical Workers

Direct negotiations between the French and German chemical industries have taken place with a view to the transfer of skilled workers from French plants to the industrial centres of Germany. I. G. Farbenindustrie alone, according to a report of the Swiss paper *Neue Zürcher Zeitung*, has called for 7000 chemical workers from France. The chemical industry is one of the six trades in which direct contact has been made between French and German organisations to facilitate the movement of workers to the Reich. The transfer does not affect individual workers, but is carried out in large groups of workers who have been together in French plants (*Betriebszellen*) and are therefore expected to adapt themselves speedily to the requirements made on them as a group in German chemical factories. The willingness to co-operate on the side of the French firms concerned will, comments the Swiss paper, depend largely on the way in which German orders for French factories are handled by the German authorities. For several months it has been noted that the amount of German orders for French factories was declining. This had the result of (a) setting labour free and (b) making available at the same time entire *Betriebszellen* for transfer to Germany.

The French workers transferred to Germany came in the earlier months mainly from the occupied zone, but now a larger number is to be recruited in unoccupied France. Many of the largest French chemical plants are situated in the unoccupied zone, and several of these have drawn attention to the fact that they find it very difficult to maintain their staff of skilled workers in the present state of raw material shortage.

Using Waste Hydrocarbons

Preparation of Hydrogen

THE consumption of hydrogen in the manufacture of synthetic ammonia, of high-octane fuel, etc., is so high and the price of these synthetics depends so much on the price of hydrogen that every new source of cheap hydrogen deserves a close attention. Rakovski and Burinova (*J. Appl. Chem. Russ.*, 1941, *14*, 449) have investigated the preparation of hydrogen from low-molecular hydrocarbons which, in Russia, are available in natural gas, in cracking gases of petroleum, in waste gases of the synthetic rubber industry, etc. The reactions leading to hydrogen formation are, for a saturated hydrocarbon, $C_nH_{2n+2} + n\,H_2O = n\,CO + (2n + 1)\,H_2$ and $C_nH_{2n+2} + 2n\,H_2O = n\,CO_2 + (3n+1)\,H_2$. At the high temperatures required for rapid reactions the hydrocarbons are partly decomposed as well, giving chiefly methane. Since hydrogen used for ammonia synthesis, etc., should not contain more than 2 per cent. of methane, the problem consists in finding a catalyst which will accelerate the reactions of hydrocarbons with water without promoting their cracking.

Special Nickel Catalyst

Rakovski and Burinova tested several catalysts. Their main ingredient was nickel, and to it various amounts of zinc, chromium, manganese, aluminium, magnesium, etc., were added. When a technical mixture of propane and butane was used, the amount of methane obtained with catalysts containing Zn, Cr, or Mn was over 1 per cent. But a non-specified addition to nickel was found, which reduced the percentage of methane formed to 0.4. The catalyst was deposited on kieselguhr (silica gel and pumice caused a considerable soot formation), the reaction temperature was 550° C., and 24 volumes of water vapour were mixed with one volume of propane-butane mixture. Conversion of ethane and of ethylene was less easy: over 99.5 per cent. of ethane was converted into H_2, CO_2, and CO when one volume of ethane was mixed with 14 volumes of water vapour, and the gas mixture passed over the catalyst within one second at 600°-700° C. Ethylene gave 0.5-1 per cent. of methane at 500°-700° C. for contact times which varied from 0.3 to 2.8 seconds. It was noted that in the conversion of both ethane and ethylene, the ratio CO_2:CO in the resulting gas was higher than that predicted by thermodynamical calculations for the equilibrium state. Methane was even more difficult to convert, but a mixture of methane (0.86 volumes) and nitrogen (0.14 volumes; a natural gas fraction) gave with 6 or 12 volumes of water-vapour at 750° H_2-CO_2-CO-N_2 mixtures containing only 2.6 per cent. or 0.6 per cent. of methane respectively. Moscow town gas containing 18 per cent. methane and 20 per cent. hydrogen had 66 per cent. hydrogen and 0.7 per cent. methane after catalysis at 800°; the ratio of water-vapour to gas was 3 : 1.

The conversion of cracking gas (a propane-butane mixture) and of a natural gas (chiefly methane) was studied on a semi-plant scale as well; 3000 litres of gas were converted per hour. The yield of hydrogen was almost quantitative for cracking gas at 550° and for natural gas at 750° C.; no soot deposition on the catalyst was observed after 15 days of uninterrupted work. The ratio of water-vapour to gas, unless too small, did not affect the yield. The speed of gas also was irrelevant. The catalyst was very stable. Its regeneration was carried out easily by oxidation and a repeated reduction; when the paper was being written some catalysts were in use for two months and had been subjected to several regenerations without losing their efficiency.

HIGH-OCTANE PETROLS

Isomerisation of paraffin hydrocarbons with aluminium chloride in presence of hydrochloric acid is reported by A. O. Bonamin to produce marked improvement in octane value and to reduce the proportion of lead tetraethyl otherwise needed for use as aviation spirit (*Rev. Fac. Quim., La Plata*, 1941, *16*, pp. 252-260). Optimum results with a mixture of pentanes, hexanes, and heptanes were achieved by treatment with 20 per cent. by weight of aluminium chloride, in presence of hydrochloric acid generated *in situ* (by addition of a little water), for 5 to 10 mins. at about 140° C. An increase of 13 to 14 in the octane value was generally secured. The method was less satisfactory when applied to mixtures containing octanes (in addition to hexanes and heptanes) since isomerisation then gave place largely to degradation reactions.

CHLORINATED OIL

Chlorine-processed oil, said to be suitable not only for lubricating machinery under normal conditions but also under conditions of extremely high temperature and pressure, such as are encountered in high-compression engines, is the subject of U.S.P. 2,281,648, granted to Everett Wiles. The process involves treating the mineral oil with chlorine gas at temperatures below 10° C. To neutralise any acids formed in the chlorinated oil it is then mixed with an alkali solution. The next step is to stabilise the oil to remove all gums and resins; this is accomplished by treating the chlorinated oil with further alkali until the gums and resins settle out.

Halogen in Organic Compounds

Determination by Means of a Simply Constructed Furnace

A SIMPLY constructed furnace, designed for use in the routine determination of halogens in organic compounds, with special reference to fluorine, has been described by P. J. Elving and W. B. Ligett (*Ind. Eng. Chem., Anal. Ed.*, 1942, *14*, 449). The furnace is of interest because it can readily be made from materials which normally are commonly available. The method is important since it permits determination of fluorine in compounds too stable to be dealt with by the more usual procedures for halogen. In addition, provision is made for the simultaneous estimation of any other halogen which may be present. The furnace consists essentially of a unit of four 12-in. iron pipes 1 in. in diameter, with a narrower tube arranged centrally to receive a thermocouple. The tubes are held in position in a galvanised iron furnace pipe ten inches in diameter by two paint-tin lids of appropriate size. The protruding ends of the tubes are threaded to take pipe couplings. When the furnace is in use the couplings allow closure by screwing in perforated cast iron plugs.

The original furnace was designed for use on a 110 volt supply, the heating element being 17.5 ft. of No. 23 chromel wire (1.25 ohms per ft.). This winding can easily be

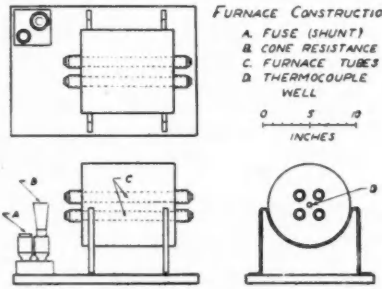

Fig. 2. Diagrammatic sketches of halogen-determinating furnace.

modified to suit other voltages. Asbestos paper insulates the tubes from the wire winding, and further insulation is placed between the winding and the outer jacket. A resistance (which may be shunted out) serves to maintain the furnace at 400° C. In the original 110 volt furnace this resistance consisted of 4 ft. of No. 19 chromel wire (0.5 ohm per ft.). The complete furnace is simply mounted as illustrated. Pyrex reaction tubes of the type shown lying beside the furnace in Fig. 1 are constructed from 2 by 15 cm. Pyrex ignition tubes by sealing on 12 cm. lengths of 1 cm. tubing. (As the analytical procedure to be followed affects the glass hardly at all, the tubes may be used repeatedly by sealing on fresh lengths of 1 cm. tubing.)

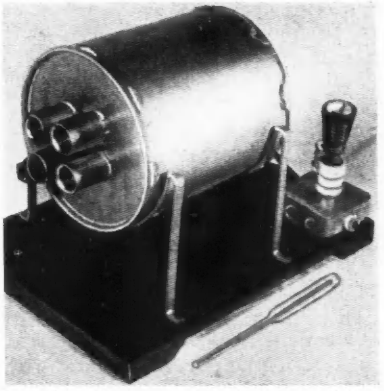

Fig. 1. Furnace for halogen determination.

Halogen compounds containing only chlorine, bromine or iodine are weighed out (0.10-0.15 g.) in a suitable ampoule which is sealed and placed in a fusion tube along with 5 ml. of completely anhydrous ether. An excess of several hundred per cent. (0.3-0.5 g.) of small pieces of clean sodium metal is added, and the fusion tube attached to a water-pump for complete evacuation of the ether. This procedure, which removes air and water vapour, is recommended on two grounds. The sodium metal is more reactive, since it is not oxidised, but it does not attack the glass to any extent; and there is little risk of an explosion during or after the fusion. While still attached to the water-pump the fusion tube is sealed off and placed in the (heated) furnace at 400° C. for 15 minutes. There is no necessity to leave the tube in the furnace to cool as one does in a Carius estimation. It may be withdrawn and cooled in the open, thus saving a considerable amount of time. On cooling and opening the tube, the excess sodium is decomposed by alcohol. The contents of the tube are washed out with water, and the solution filtered. After neutralisation of the filtrate with nitric acid, the halide is estimated gravimetrically as silver halide.

Many fluorides do not react completely

under the above-described conditions of fusion. It is therefore recommended that when dealing with these compounds potassium be substituted for sodium, and the heating be continued for 30 minutes. Otherwise the fusion procedure is similar to that for the other halogen compounds. In the filtrate the fluorine is determined by precipitation as lead chlorofluoride. It is quite feasible to estimate both fluorine and chlorine in a single sample of a fluorochloro compound, aliquot parts of the fusion filtrate being used for the two determinations. However, the accuracy does not seem in general to be as high as for the compounds containing only a single halogen.

Turkish Chrome

Negotiations for New Agreement with United Kingdom

IT is reported from Istanbul that negotiations are in progress between the British and Turkish Governments for a renewal of the agreement concerning British purchases of chrome from Turkey. The agreement in force at present is due to expire on January 8 next, having been in operation for three years. By this agreement Britain had the first claim on practically the entire Turkish production of chrome, although the Germans have been trying for some time to secure a large supply of this material. So far, however, the Turkish Government has only promised to supply Germany with chrome on the following conditions: between January 15 and March 31, 1943, Turkey and Germany would exchange products to the value of £T 55,000,000, Germany to deliver goods partly consisting of war material and partly of commercial supplies, while Turkey would deliver 45,000 tons of chrome and the remainder in other products. From March 31 to the end of 1943, Turkey would deliver another 45,000 tons of chrome, and in 1944, 90,000 tons more, all of which was to be exchanged against German war material. A uniform condition was that Turkish goods should be delivered only after the arrival of German articles to the same value on Turkish territory.

German Efforts

The capacity of the Germans to deliver large quantities of war material being very doubtful (and to no one more doubtful than to the Germans themselves), they have been endeavouring to persuade the Turkish Government to let them have immediate supplies of chrome against credits, spare-part deliveries, etc. The Turkish Government, however, has consistently refused to be drawn into any such bargain. In view of the improbability of the delivery of the required quantities of material by Germany in 1943, it is to be hoped that the new Turco-British agreement will result in the continuance of large consignments of Turkish chrome to this country.

Parliamentary Topics

Oil from Waste

IN the House of Commons last week, Sir I. Albery asked the Minister of Supply whether he was satisfied that adequate steps were being taken to reclaim for further use the material from used oil-saturated cotton waste. Mr. Peat replied that adequate arrangements were in operation for recovering and treating oily rags, cotton waste and wipers from Government factories, the Services, and the railway companies. A considerable number of processing firms throughout the country were treating such material arising from commercial sources; but further measures might be necessary.

Calcium in Bread

Sir E. Graham-Little asked the Parliamentary Secretary to the Ministry of Food whether, inasmuch as milk was recognised as the best source of calcium in the diet and the supply of milk had progressively increased since the outbreak of war, he would reconsider the decision to add chalk to the national bread. Mr. Mabane stated that the Minister of Food was not prepared to reconsider his decision to make some addition of calcium to the national flour. While the overall consumption of milk had increased since the outbreak of war, the intake of calcium per head of the population prior to the war was abnormally low.

Wheat Germ

Sir E. Graham-Little also asked what proportion of the wheat germ separated from the grain in milling had been allocated during the past three months to proprietary products, whether foods or medicines, and to be at the disposal of the millers in the ordinary way of trade, respectively. Mr. Mabane answered that during the last three months more than 99 per cent. of the output of germ not retained in flour had been used in proprietary products, either foods or medicines. Less than 1 per cent., which for reasons of quality was not acceptable for these purposes, had been used in other ways.

Soya Planting

To a question by Sir F. Fremantle as to whether anything was being done by the Ministry of Food to get into touch with the Ministry of Agriculture to encourage the planting and growing of the soya bean in this country, Mr. Mabane asked for notice before giving an answer.

A CHEMIST'S BOOKSHELF

THE KODAK BOOK OF APPLIED PHOTOGRAPHY. London: Kodak, Ltd. Loose leaf. 10s. 6d.

It is most regrettable that as a result of the war the publishers can at present supply this book only to industrial firms and scientific institutions using photography in their work. One must look forward to the time when it will be possible to make the book available for sale to the general public. The multiplying uses of photography have induced a demand among scientists and technicians for a reference book which will give help on the many practical problems which continually arise. Some sort of loose-leaf system such as that devised by the publishers of this volume seems the happiest device for covering the demand. The *Data Book* has been conceived in no spirit of parochiality, but with an eye to the photographic needs of all scientists and industrialists. Which grade of plates should I use? What processing error causes the flaws in my films? Can I apply photographic methods to my filing needs? Am I employing the best developer for my enlargements? How can I record my photomicrographs in colour? Can I introduce infra-red photography with advantage? How can the cine-camera stimulate my sales?

These constitute only a snatch-sample of the many questions dealt with on well over a hundred data sheets. The subscription allows for a periodical supply of further data sheets, on topics preferred by the purchaser, up to a total number of 200. The ring binder is constructed with a view to containing this number of sheets. A word must be devoted to the excellent system of cross-referencing which permits ready classification of the sheets into groups which will suit the individual user of the book, be he spectroscopist, X-ray photographer, microscopist, business manager, or in any one of a dozen other categories. Kodak, Ltd., are to be congratulated on the enterprise behind this valuable collection of information, no little of whose worth lies in its power to expand.

ANNUAL REPORTS ON THE PROGRESS OF APPLIED CHEMISTRY, 1941. Vol. XXVI. London: Society of Chemical Industry. Pp. 545. 16s., to members 10s. 6d.

With some slight contraction which, evenly distributed through the reports, excludes nothing of importance from this valuable publication, the present edition shows little alteration from the previous issue in the ground covered. There are again 26 separate reports, the only important title change being the addition of "Starches" to the article on "Sugar" published last year. The material maintains the high standard of authority and presentation of past years while the method of indexing ensures that subscribers get full value from the book. Last year it was found necessary to increase the price to non-members of the Society. This time members are required to find another 3s.

PRODUCER-GAS PLANT FOR INDUSTRIAL PURPOSES. By a Technical Committee, for the National Federation of Gas Coke Associations, the British Hard Coke Association, and the South Wales Anthracite and Dry Coal Committee. Pp. 86. 5s.

The technical committee drawn from the three industries concerned has dealt fully, and with a wealth of diagram, with the operation and maintenance of producer-gas plant in this well set out survey of a subject of topical importance. The book takes the general reader as well as the producer-gas plant operator in a most interesting fashion through an examination of the theory of the gas producer, descriptions of the generator, washer-coolers, filters, fans and so on, and includes an analysis of gas, methods of sulphur removal, and a survey of producer-gas utilisation and the types of plant on the market. There is an appendix, illustrated with photographs, of precautions which should be taken against carbon monoxide poisoning and the treatment of casualties. In the majority of installations, say the writers, it is not considered necessary to remove sulphur, and unpurified gas containing up to about 70 grains of sulphur per 100 feet is fed direct to the appliances. This is justified with certain precautions but, it is said, when unpurified gas is used it should be remembered that the hydrogen sulphide present will attack brass connections or valves, and special maintenance should therefore be provided for such fittings. Wherever possible cast or malleable iron valves and fittings should be used.

PENTATHIONIC ACID

According to a recent study by R. A. C. Gherzi (*Rev. Fac. Quim., La Plata*, 1941, *16*, pp. 99-102) the possibility of formation of pentathionic acid from sulphur insecticides when applied in aqueous suspension to vegetation is exceedingly remote. Commercial sulphurs of varying degrees of purity were tested *in vitro* by suspending in water, exposing to air and light for considerable periods, and applying specific tests for pentathionic acid. The only material to give a positive reaction, after 144 hours, was a "black insecticidal sulphur" containing only 37 per cent. free sulphur and apparently consisting of a spent iron oxide gas-purifying mass. In actual plant tests, however, neither this nor any other grade of sulphur gave a positive reaction.

Personal Notes

SIR EUGENE RAMSDEN, Bt., M.P., has been appointed deputy chairman of Thomas Bolton and Sons, copper manufacturers.

DR. F. H. GARNER, F.I.C., M.I.A.E., M.I.Chem.E., F.Inst.Pet., has been appointed to the Chair of Oil Engineering and Refining at the University of Birmingham, in succession to the late Professor Nash.

MR. NORMAN NEVILLE has been appointed director of the British Chemical Plant Manufacturers' Association in view of the continued absence of Mr. J. Davidson Pratt on Government service.

MR. N. H. DEARBORN, of New York City, has been named executive vice-president and managing director of the U.S. National Safety Council, in succession to MR. W. H. CAMERON, who is retiring after almost 30 years as managing director of the Council.

After 46 years in the laboratories of the Workington Iron and Steel Works, MR. PERCY REES, analytical chemist, has retired. Mr. Rees began his career at the Derwent Works when they belonged to Cammell Lairds.

MR. I. F. L. ELLIOT, who has been commercial director of the British Iron and Steel Federation and managing director of the British Iron and Steel Corporation since November, 1935, has ceased to hold these offices.

DR. NORMAN A. SHEPARD, chemical director of the American Cyanamid and Chemical Corporation, now serving with the War Production Board, was recently elected vice-chairman of the American Section of the Society of Chemical Industry.

CAPTAIN THOMAS B. CLARK, of Auchtermuchty, who, before joining up, was employed with the Imperial Chemical Industries at Billingham, has been promoted to the rank of major. Captain Clark was in the Singapore garrison when the island was taken, but he managed to escape to India.

SIR JOHN DUNCANSON, who has been deputy controller in charge of iron and steel supplies since September, 1940, has been appointed Iron and Steel Controller in succession to SIR CHARLES WRIGHT, who has resigned for reasons of health. Sir John is a director of the Steel Company of Scotland, a subsidiary of Colvilles.

MR. B. E. WILLIAMS, on retirement from business, is relinquishing, on October 1, the appointment of joint managing director of Turner and Newall, Ltd., but remains an ordinary director of the company. MR. W. W. F. SHEPHERD, joint managing director, becomes deputy chairman. MESSRS. H. HANSON, R. GRAY SOOTHILL, and G. WILSON, all of whom have been associated with the company for many years, are appointed directors. Mr. Shepherd is a director of the Carbon Dioxide Company, Ltd.

Obituary

MR. FRANCIS JOHN TENNANT, who died recently at North Berwick, aged 61, was a director of Charles Tennant & Co., Ltd.

MR. W. E. MARWICK, joint manager of the Newcastle-on-Tyne branch of the International Paint and Compositions Co., Ltd., for 23 years, has died, aged 60, at Benton, Northumberland. He had been with the firm for 44 years.

MR. T. B. BLAKE, of Middlesbrough, who died on September 10, aged 67, was for 24 years works engineer to Sadler & Co., Ltd., chemical manufacturers. He was chairman of the House Committee of the North Ormesby Hospital, in which he died.

Barium Perchlorate

Electrolytic Preparation Method

BARIUM perchlorate, which is used as such and as material for manufacturing other metal perchlorates, can be prepared by electrolytic oxidation of barium chlorate which, in turn, is obtained from electrolysis of barium chloride by a standard procedure. E. Beinarovich and V. Stender (*J. Appl. Chem. Russ.*, 1941, *14*, 494) examined the conditions giving the best yield of perchlorate. Platinum electrodes were used. The concentration of barium chlorate is not critical; 250 g. per litre is convenient. Commercial barium chlorate contains some barium chloride; its concentration is important. Chloride ion is oxidised at the anode to chlorate, consuming 9 faradays per mole, thus causing a considerable waste of current. At the first stages of the electrolysis—*i.e.*, as long as the solution contains nearly as much chlorate as perchlorate—this waste of current can be reduced by surrounding the electrodes with glass cylinders, but this device becomes harmful towards the end of the electrolysis. The best means is to keep the initial concentration of chloride low; it should not exceed 1 g. per 50 g. of chlorate. Probably because of the chloride content of the solution the most favourable anodic current density during the first half of electrolysis is high, *e.g.*, 3 amp./sq. cm.; later on 1 amp./sq. cm. gives a higher yield. The cathodic current density is less important, especially during the second half of the electrolysis; 1 amp/sq. cm. is a convenient value. The temperature must be kept low—at, say, 20°-25° C. Presumably chlorate is oxidised to perchlorate by hydrogen peroxide, and the latter at higher temperatures decomposes so rapidly that it has no time to affect the oxidation.

General News

From Week to Week

A new Consolidating Order, entitled the Trading with the Enemy (Specified Persons) (Amendment) (No. 14) Order, 1942 (S.R. & O. 1942, No. 1713), was published by the Board of Trade on September 15 (price 3s.).

Salford education authority is to experiment with the addition of a specially prepared tablet containing vitamin C to the morning milk issued to a number of selected children. If satisfactory results are obtained, the tablets will be given to all the school children taking school milk, at a cost of about £5000 a year.

A new course in chemistry is to be provided by the Widnes Municipal Technical College; it is approved by the Institute of Chemistry for the training of candidates for the A.I.C. examination. The course will be conducted by Dr. J. T. Owen as full-time lecturer, and he will be assisted by Dr. W. C. Davies, Mr. F. E. Rymill, and Mr. A. V. Harrison.

A factory in Airdrie, which has been used for the manufacture of ice-cream, has been taken over as a collection centre for the rose hips which are to be gathered this season, according to a statement made by Mr. C. S. Blake, secretary to the National Scottish Rose Hip Collection Centre. This collection will be continued after the war.

Waste paper is used for making expansion joints for the concrete runways of aerodromes. The joints are inserted between the concrete blocks so as to allow for the expansion and contraction of the cement under climatic changes, thus preventing cracking. One firm alone is using approximately 1300 tons of paper a year in the making of a bituminous composition for this purpose.

The Board of Trade has decided, with the approval of the Treasury, that the premium payable under the Business Scheme for the whole year to September 30, 1943, shall not exceed £1 per cent. For the period of six months up to March 31, 1943, the rate of premium will be 10s. per cent. and will be payable in one sum. The rate of premium for the subsequent six months will be determined in March next and will not exceed 10s. per cent.

The Industrial Pest Control Association, which has been formed recently, comprises 40 members representing firms in all branches of industrial pest control outside agriculture; one of its main aims is to stimulate activity in relation to food storage and the war effort. The honorary secretary is Dr. E. Holmes, Jealott's Hill, Bracknell, Berks., who is supported by an influential executive committee and a small technical sub-committee with powers to co-opt representatives for special purposes.

A second edition of "The Application of Absorption Spectra to the Study of Vitamins, Hormones, and Coenzyems," by Dr. R. A. Morton, has just been issued by Adam Hilger, Ltd. (price 28s.). Another new scientific book of outstanding interest is "Spectroscopy and Combustion Theory," by Dr. A. G. Gaydon (Chapman & Hall, 17s. 6d.).

The Control of Rubber (No. 16) Order (price 2d.) imposes further limitations on the quantity of crude rubber or balata which may be used in the production of conveyor, elevator or transmission belting, and prohibits the manufacture of certain types of belting. By the Control of Rubber (No. 17) Order (price 3d.) the manufacture of rubber hose is brought under control. Both orders came into force on September 17.

The first producer-gas bus operated on Tyneside has made its appearance on the Newcastle-on-Tyne—Whitley Bay route. One of the first passengers was Sir John Maxwell, Northern Regional Transport Commissioner. United Automobile Services, Ltd., owners of the bus, have been experimenting for some years with producer-gas and, in this way, have already saved about 9500 gallons of petrol.

A committee has been formed under the chairmanship of Sir John Russell, F.R.S., to work with the Allied Technical Advisory Committee on scientific problems connected with post-war agricultural reconstruction in devastated Europe. Another committee, with Dr. Dudley Stamp as chairman, will consider the further application of science to rural planning, as suggested at the Conference on science and world order in 1941.

It is hoped to arrange an examination for the Association of the Institute of Chemistry, to be held in January, and examinations for the Associateship and Fellowship in April, 1943. The dates and places at which they will be held will be notified to intending candidates, who are asked to complete and return forms of application for admission to the examinations as early as possible, if they wish to present themselves in January, 1943, not later than November 9, 1942.

The Minister of Supply, in consultation with the Secretary of State for Scotland, has made the Control of Fertilisers (No. 26) Order, 1942, which prohibits the sale of potassic or phosphatic fertilisers in Scotland for delivery more than 60 days ahead. Fertilisers containing imported potassium salts may only be acquired by farmers in Scotland on completion of a "Grower's Declaration" or against a "Potash Allotment Note," issued by an agricultural executive committee.

Foreign News

The production of anhydrous alcohol in Brazil during 1941-42 totalled 110,116,060 litres.

A new sulphite alcohol distillery has been opened at Hurum, Norway, by A/S Tofte Cellulose Fabrikker.

Ferric ammonium citrate and anhydrous basic subacetate of lead are among the industrial chemicals quoted as now being manufactured in Australia.

Canadian-made magnesium is now available for the first time. A new £1,000,000 Government-owned magnesium factory is in operation.

The Canadian Liquid Air Co., Ltd., contemplates the erection of an acetylene plant and installation of equipment at Vancouver at an estimated cost of £37,500.

The recovery of fatty materials from waste waters is being encouraged by the Vichy Government, who have asked firms with experience in the construction of suitable plant to report to the authorities.

French production of power alcohol will not increase this year, but for 1943 an expansion by 20 per cent. is hoped for as a result of the increase of the acreage under sugar beet.

Following the comprehensive Brazilian economic agreements with the U.S. and British Governments, a new entity, Companhia Vale do Rio Doce S.A., has been formed to exploit the Itabira iron mines.

Salt production in Bulgaria, at present 8000 to 10,000 tons per annum, is to be raised within the nextfew years to 50,000 tons. The existing works have been nationalised and are operated under the directions of the Ministry of Agriculture.

Synthetic Resins, Ltd., has begun operations at its plant at Galt, Ontario, where plans for a wide range of synthetic materials are contemplated. At present the company is concentrating of the production of waterproofing materials for war purposes.

The 31st National Safety Congress and Exposition of the United States will be held on October 27-29. It will be housed in three big Chicago hotels, the Sherman (also Convention headquarters), the La Salle, and the Morrison.

Synthetic rubber from sulphite alcohol is now produced by the Swedish cellulose firm, Mo and Domsjö, at the rate of 100 kilograms a day. A factory capable of producing 200 tons of the material (which will be marketed under the trade name "Modo") is under construction. Experiments on the manufacture of synthetic rubber are also being carried out by Allmänna Svenska Elektriska A/B at Västeras, with the support of the Industrial Commission.

Annual steel making capacity of the U.S., already at the highest level in history, increased by 628,350 tons during the first half of 1942, and is estimated now at a total of 89,198,320 net tons per year. In 1917, the annual capacity was 52,640,000 tons.

Herring oil is said to have proved quite satisfactory for paint manufacture in Denmark, provided that it is suitably purified. The entire production is in future to be subjected to special treatment, and oil produced from small herrings is to be used as a substitute in tanneries.

In South Africa experiments are being conducted in the manufacture of wax from sugar-cane. A practical method of extracting wax from filter-cake, which is said to contain a relatively high wax content, is being examined. Commercial production of glycerine from molasses is already in hand.

Heavy damage in a recent air-raid on the Rhein Prussen synthetic oil plant has been announced. The works are situated at Mörs, on the left bank of the Rhine, just west of the Ruhr district, and it is reported that a maintenance workshop has been badly damaged, a storage tank destroyed, and a gasholder demolished.

Forthcoming Events

On **September 22,** at 11 a.m., in the lecture theatre of the Royal Institution, 21 Albemarle Street, London, W. 1, the **Institute of Physics** will hold a discussion on the determination of equilibrium diagrams by X-ray methods. An introductory statement will be made by Sir Lawrence Bragg, F.Inst.P., F.R.S.

The Glasgow and West of Scotland Section of the **Institute of Chemistry** will hold a meeting jointly with the local sections of the **Chemical Society** and the **Society of Chemical Industry,** on **September 25,** at 7.30 p.m., in Room 24, Royal Technical College, Glasgow. Dr. J. J. Fox will read a paper on "Some Experiments in Infra-Red."

A joint meeting of the Manchester Section and the Food Group of the **Society of Chemical Industry** will be held on **September 26,** at 2.30 p.m., in the Reynolds Hall, College of Technology, Manchester, when Dr. L. H. Lampitt will deliver a lecture on "The Preservation of Foodstuffs."

On **September 26,** at 6.30 p.m., the Huddersfield Section of the **Institute of Chemistry** will meet at Field's Cafe, when Mr. A. L. Bacharach will deliver a lecture entitled "Some Aspects of Nutrition in War-Time."

The opening meeting of the **Electrodepositors' Technical Society** will take place at the Northampton Polytechnic, St. John Street, E.C.1, on **September 28,** at 6 p.m., when the following paper will be presented: "Electro-Chemical Methods for Rust-Proofing," by H. Silman, B.Sc.

COUPONS FOR CHEMICAL WORKERS

Under a Board of Trade scheme which comes into force on September 21, ten supplementary clothes coupons are to be issued to certain classes of industrial workers. Employees in the heavy and fine chemical industries, in plastics, fertilisers, dyes, rubber and synthetic rubber, and cellulose, and laboratory chemists and their assistants are among the workers listed in Leaflet G.O.S. No. 10 obtainable from the Board of Trade. Workers wishing to claim coupons must obtain form E.D.277 from their trade union or their employer.

Company News

The net profit of the **United Indigo and Chemical Co., Ltd.,** for the year to June 30, 1941, was not £11,483, as quoted in our issue for September 12 last, but £9483.

Lever Brothers and Unilever, Ltd., have declared a dividend on the ordinary shares of 5 per cent. (same) for the year ended December 31, 1941, payable on October 13; net profits for the year, before appropriations but after taxation, £5,835,529 (£6,987,130); consolidated profits, including the company's proportion of profits, less losses of subsidiary and allied companies, after E.P.T. but before British income-tax, £10,562,540 (£11,225,451).

British Chemical Prices

Market Reports

A STEADY movement into consumption is taking place in most sections of the industrial chemicals market and values throughout continue to display a strong tendency. Delivery specifications have covered good volumes and prices generally remain firm. The demand for the soda products continues on a good scale with such items as bichromate and chlorate of soda in restricted supply. A steady demand is reported for Glauber salt, salt cake and hyposulphite of soda. Among the potash materials an active inquiry is reported for both the B.P. and commercial grades of permanganate of potash and elsewhere in this section supplies of caustic, bichromate and yellow prussiate of potash are quickly absorbed for priority needs. In other directions arsenic is a good market and a steady demand is reported for the red and white leads. Market activity in the coal-tar products section is fairly brisk and there is a good call for creosote, carbolic acid, and cresylic acid, while there is a ready market for toluols. Elsewhere pyridine and pitch are receiving a moderate inquiry.

MANCHESTER.—Prices on the Manchester chemical market during the past week have shown few actual changes of any consequence, but in virtually every section the undertone is distinctly strong, and additional advances during the coming months would occasion little surprise. In the meantime, the movement of supplies under contracts is on steady lines and specifications have been circulating fairly freely, particularly for textile and rubber chemicals. Fresh bookings during the week have been on a moderate scale. In the by-products section, with one or two exceptions, good quantities of both the light and heavy materials are leaving the works.

GLASGOW.—The general position in the Scottish heavy chemical trade remains unchanged. Prices remain very firm with a tendency to rise in certain instances.

Price Changes

Pitch.—MANCHESTER: 46s. per ton at works.

Potassium Prussiate.—Yellow, 5 cwt. to 7 cwt., casks, 1s. 6d. per lb., d/d; supplies scarce.

Sodium Sulphide.—Solid, 60/62%, spot, £17 15s. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Chemical and Allied Stocks and Shares

FOLLOWING last week's upward trend, Stock Exchange markets have become moderately reactionary owing to the absence of further improvement in the volume of business. There was, however, very little profit-taking, and consequently, in many directions, recent gains have been fairly well maintained. Various shares of companies connected with the chemical and kindred industries were marked down in the absence of confirmation of market hopes of improved dividends for the past financial year. Triplex Glass 10s. units have been lowered to 30s. 7½d. on the reduced profits (the dividend is again 10 per cent.), awaiting the full report and the chairman's annual statement. Lever & Unilever have declined on balance from 30s. 3d. to 29s. 3d. on the 5 per cent. dividend, the market also having been hopeful that a small increase in dividend might have been forthcoming in this case. At current prices Triplex and Lever & Unilever offer only very moderate yields, but similar remarks apply to many leading industrial securities, the disposition being for market values in many cases to be governed mainly by the strength of the balance-sheet position and by views current as to the scope for recovery in earnings.

Imperial Chemical at 33s. 6d. were slightly higher as compared with a week ago, awaiting the interim dividend announcement, while in other directions, B.

Laporte were more active than for some time past and have transferred up to the enhanced level of 70s. Fison Packard changed hands at 36s. 9d. at one time, and Cooper McDougall at 24s. 4½d. Goodlass Wall 10s. ordinary held their recent improvement, having been dealt in up to 12s. 1½d. Among smaller-priced issues, British Glues 4s. shares transferred at 6s. 4½d., and Greeff-Chemicals at 5s. 9d., while Low Temperature Carbonisation 2s. shares were again around 1s. 8½d. Firmness was maintained in Borax Consolidated, which were slightly higher at 33s.; the yield on the 7½ per cent. dividend paid last year is not large, but is in line with yields on many other leading industrial securities today. General Refractories were maintained at 12s. 7½d., and Imperial Smelting were little changed at 11s. 7½d., while at 16s. 3d. Amalgamated Metal shares have more than held the improvement referred to a week ago. Similar remarks apply to British Match, which are 36s. 6d. at the time of writing, while Dunlop Rubber ordinary units have improved on balance from 28s. 5d. to 29s. 6d. Elsewhere, Barry & Staines have further risen from 34s. 3d. to 35s., and Nairn & Greenwich from 53s. 1½d. to 53s. 9d.

Wall Paper Manufacturers deferred units at 28s. 3d. held last week's improvement. The market is doubtful whether the forthcoming dividend on the last-named will be more than maintained, but this is another case where the market value of the shares tends to be governed mainly by the financial position and by views as to recovery in earnings after the war. British Plaster Board, however, lost 3d. to 25s. 9d., but remained active, as did various shares of companies associated with plastics. British Industrial Plastics 2s. ordinary transferred up to 5s., and Lacrinoid Products up to 4s. 10½d. Erinoid 5s. ordinary were active up to 10s. 6d., there being talk in the market that the forthcoming results may show a moderately higher dividend. At 29s. 4½d. United Molasses have lost part of their recent rise, but at 79s. 6d. the units of the Distillers Co. were well maintained. Associated Cement were 51s 10½d., awaiting the interim dividend announcement. Boots Drug were slightly easier at 37s. 3d., while Sangers were 17s. 7½d., and Timothy Whites 22s. 7½d. Firmness was shown by British Aluminium at 45s., and by British Oxygen at 67s. 6d. Business at 55s. 3d. was done in United Glass Bottle ordinary, and at 5s. 9d. in the 5s. shares of Canning Town Glass. The tendency in oil shares has been favourable on balance, sentiment having remained under the influence of satisfaction with recent dividend announcements.

CLASSIFIED SECTION

NOTE Trade announcements, other than strictly second-hand and job lines, cannot be inserted in these pages except by firms whose advertisements run in the display columns.

APPOINTMENT VACANT

REQUIRED—Metallurgist for large Iron and Steel Foundry in South Wales engaged on manufacture of Machine Tools. State experience and salary required. Please reply to Box No. 2081, THE CHEMICAL AGE, 154 Fleet Street, E.C.4.

EDUCATIONAL

FOR SALE

Second-hand
CHEMICAL PLANT
For Sale.

60 Gallon capacity Copper RECTIFYING STILL by Haslam, 36 in. dia. by 25 in. deep; bolted dome cover; nest of copper steam pipe coils in bottom; complete with 12 tray fractionating column, condenser and spirit safe all in copper; complete with vapour pipe and all fittings.

40/50 Gallon capacity Copper RECTIFYING STILL by John Dore, 32 in. dia. by 26 in. deep; bolted dome cover; copper steam pipe coil in bottom complete with vertical fractionating column in four bolted sections, condenser, spirit safe, all in copper plate, with necessary fittings.

Copper STEAM JACKETED VACUUM STILL, 2 ft. dia. by 3 ft. 6 in. deep; bolted dome cover secured by four swing bolts, arranged for tilting on trunnion bearings and mounted in cast iron side frames, complete with all necessary fittings.

Horizontal Cylindrical VACUUM OVEN, 2 ft. 8 in. dia. by 4 ft. long; hinged dome cover secured by swing bolt; Oven fitted internally with nine steam heated shelves with trays; the whole mounted on angle iron frame.

Water Jacketed GLASS LINED BOILING PAN by Pfaudler, 1 ft. 9 in. dia. by 2 ft. 8½ in. deep; welded steel water jacket; Pan arranged for bottom run-off 2 in. dia., complete with spring loaded relief valve. Pan mounted on four tubular legs.

EARTHENWARE WATER JACKETED PAN, 2 ft. 3 in. dia. by 2 ft. 10 in. deep; earthenware dome cover; cast iron water jacket complete with drain and outlet cocks; whole mounted on three cast iron tubular legs.

Copper VACUUM DISTILLATION UNIT, comprising steam jacketed Copper Still, 2 ft. 6 in. dia. by 3 ft. 6 in. deep and arranged with nest of all copper coils in bottom; 3 in. bottom outlet complete with swan-neck, vapour pipe and all copper condenser and all necessary gauges, fittings, etc.; mounted on three 2 in. dia. tubular legs.

Horizontal TWIN BLADED MIXER by Savy, Jean Jean of Paris; 2 ft. 6 in. long by 2 ft. 3 in. wide by 1 ft. 10 in. deep; double fan type mixing blades, chain driven through machine cut gearing; vertical tilting screw hand operated through bevel gears; Mixer mounted on heavy c.i. stand.

GEORGE COHEN, SONS & CO., LTD., STANNINGLEY, near LEEDS, and Wood Lane, London, W.12.

FOR SALE

100 REBUILT Hydro Extractors by all leading makers from 18 in. upwards with countershafts attached and safety covers. Jacketed Steam Pans, various sizes. List on request. Seen at Randalls, Arundel Terrace, Barnes. Telephone: Riverside 2436.

1000 STRONG NEW WATERPROOF APRONS. To-day's value 5s. each. Clearing at 30s. dozen. Also large quantity Filter Cloths, cheap. Wilsons, Springfield Mills, Preston, Lancs. Phone 2198.

HYDRAULIC TUBING, 1 in., large quantity, secondhand, new condition, also limited quantities other sizes and fittings. Hydraulic Valves, new, various types against requirements. Thompson & Son (Millwall), Ltd., Cuba Street, Millwall, London, E.14. East 1844. —

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WANTED.—Supplies of Baddelyite, Analyses and Quotations to Box No. 2080, THE CHEMICAL AGE, 154 Fleet Street, E.C.4.

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PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD. (B. T. King. A.I.Mech.E., Patent Agent), 146a Queen Victoria Street, London, E.C.4. ADVICE Handbook, and Consultation free. 'Phone: City 6161.

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